

shot his drift-nets at the trace depth. Although the trace persisted during the whole of the time that the nets were in the water, the total catch was only one adult herring; but entangled in the nets were vast numbers of small fish, a sample of which was collected and identified as post-larval unsealed herring of 3-4 cm. in length.

B. B. PARRISH
R. E. CRAIG

Marine Laboratory,
Wood Street, Torry,
Aberdeen.

¹ Burd, A. C., and Lee, A. J., *Nature*, **167**, 624 (1951).

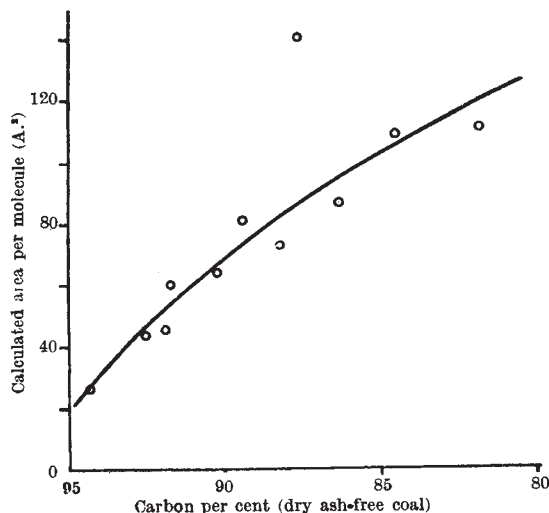
² Hodgson, W. C., *Min. Agric. Fish., Fish Invest.*, Ser. 2, **17**, No. 4 (1950).

Adsorption on Coal

IN a recent letter in *Nature*¹, Lecky *et al.* have reported that surface areas of coal obtained from low-temperature nitrogen adsorption are considerably smaller than areas determined from water and methanol adsorption, while Malherbe² found a similar discrepancy between areas of coal determined from low-temperature argon adsorption and heats of wetting in methanol. The doubts thus cast on the extent of the internal surface area of dry coal samples do not, however, necessarily apply to coal in its wet and swollen state, and it is in this form that coal is encountered in wet processing and also, as dust, in the lungs of coal-miners.

I have studied adsorption of organic molecules from aqueous and alcoholic solutions on coal. Adsorption on high-rank coals (for example, the anthracites) is often very high, even with low molecular weight solutes which give no evidence of multimolecular adsorption, suggesting that for these coals the heat of wetting in methanol does not over-estimate the internal surface. The area per molecule of solute, calculated from the apparent adsorption at final concentrations of 0.100 *N*, decreases as the rank of coal (and percentage carbon) decreases and the oxygen content increases. The accompanying graph gives results for the area per solute molecule in the case of acetic acid, heats of wetting in methanol being used as a measure of specific surface³.

A similar gradation in the calculated areas is found with other solute molecules in aqueous solution, for



example, formic acid, methyl and ethyl alcohol, methyl and ethyl acetate. The slope of the curves is dependent on the particular solute, being least pronounced for methyl alcohol. Adsorption presumably takes place through the non-polar portion of the solute molecule; Traube's law for homologous series is valid for coal except in cases where molecular sieve action is pronounced.

The gradation in calculated area per molecule is probably largely due to a true decrease in adsorption per unit area as the coal becomes more hydrophilic. Dependence of heats of wetting on the composition of the surface may be a contributory factor.

The available results will be more fully reported elsewhere. The observations reported above were obtained on coal samples supplied by the British Coal Utilization Research Association, by whom the heat of wetting determinations were carried out.

G. GARROD THOMAS

Pneumoconiosis Research Unit,
Medical Research Council,
Llandough Hospital,
Nr. Cardiff.
July 26.

¹ Lecky, Keith Hall and Anderson, *Nature*, **168**, 124 (1951).

² Malherbe, *Fuel*, **30**, 97 (1951).

³ Maggs, *Proc. Conference on Ultra-fine Structure of Coals and Cokes*, 95 (B.C.U.R.A., 1944).

Observation of Cool Flames with Ethylene

IN the course of investigations into the inflammability of ethylene/oxygen/nitrogen mixtures, some interesting observations have been made on the type of flame produced by spontaneous ignition at 300°. Experiments were carried out in a cylindrical steel bomb (explosion cavity 3.8 cm. dia. and 15.3 cm. long) mounted vertically and fitted with a quartz window near the top.

Several mixtures, containing 5-6 per cent of oxygen and 15-68 per cent of ethylene, were fed into the bomb at 300° and pressures up to 40 atm., and found to give rise spontaneously to two quite different types of flame.

(1) At 17-41 atm., a pale blue flame moving downward through the mixture. The flame front was about $\frac{1}{8}$ in. thick, nearly planar, and possessed no tail. It travelled at a speed of approximately 1 cm./sec. and was associated with a gentle pressure 'pulse' of 0.5-1.0 atm. Titanic sulphate indicated small quantities of peroxides in samples of the gas taken immediately before or immediately after the passing of the flame. 50-90 per cent of the oxygen was consumed, 20-28 per cent being converted to formaldehyde and 1-2 per cent to acetaldehyde.

(2) At 25-41 atm., normal ignition occurred. The flame was bright red and moved too rapidly for visual perception of the flame front, that is, at least at (and possibly much faster than) 50 cm./sec.

Much soot was produced and the gauge registered a sudden kick that sometimes exceeded 30 atm. No peroxides were detected, but all the oxygen was used up, about 16 per cent being converted to formaldehyde and 1-2 per cent to acetaldehyde.

The pressure at which the flame characteristics changed depended on the composition of the gas, and for each gas was located within a range of some 2-3 atm. Within this range, a two-stage ignition could sometimes be observed, the blue flame being